INVESTMENT INSIGHTS

Focusing on hedge fund volatility

Keeping alpha with the beta

November 2016

IN BRIEF

- Our Long-Term Capital Market Assumptions (LTCMAs) for hedge fund volatility are designed to provide estimates of the volatility of returns likely to be experienced by a "typical" hedge fund allocator—one diversified across standard hedge fund strategies, with a handful of managers selected in each.[1]
- HFRI strategy class indices—equally weighted composites of hundreds of hedge funds—can diversify away much of the volatility associated with the uncorrelated, manager-driven component of hedge fund returns (alpha), significantly understating the typical allocator's risk experience.
- We address this potential understatement of volatility and alpha risk by basing each strategy-level estimate on the median range of volatilities among 1,000 randomly selected portfolios of three to five hedge funds.
- Additionally, we correct for the smoothing effect on returns of the illiquidity of many hedge fund investments—another factor that can lead to underestimation of hedge fund volatility.
- Final estimates of volatility combine these quantitative adjustments with our qualitative views of market trends and their impact on hedge fund risk taking.

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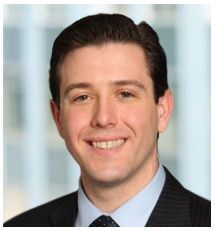

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HEDGE FUNDS BY DEFINITION ARE A HYBRID ASSET CLASS, with returns driven by both public market exposures (beta) and idiosyncratic strategies coupled with manager skill (alpha). The alpha component is largely responsible for hedge funds' attractive value proposition: a potential source of diversification and returns, distinct from traditional equity, commodity and fixed income sources.

The nature of this alternative strategy class presents several challenges when developing forward-looking estimates for the volatility of hedge fund strategies. Standard Hedge Fund Research, Inc. (HFRI) return indices are good measures of general trends in hedge fund industry performance. However, because these indices are constructed by combining hundreds of hedge funds into an equally weighted monthly return composite (**EXHIBIT 1**, next page), most of the idiosyncratic (or uncorrelated) components of risk are diversified away. As a result, *such indices tend to underestimate the volatility of hedge fund investments* experienced by the typical hedge fund allocator. Furthermore, the illiquidity of many hedge fund investments can mask underlying risks and result in an underestimation of the volatility of a strategy.

[1] While the number of funds in a hedge fund allocation varies significantly across investors, our experience suggests that the "typical" asset allocator (institutional investor, private wealth manager, family office, etc.) should invest in a combination of 15 to 25 hedge funds, with three to five funds per strategy.

HFRI indices are designed to capture broad hedge fund industry performance, not the typical investor's experience

EXHIBIT 1: NUMBER OF FUNDS IN HFRI STRATEGY INDICES

HFRI index	Number of funds
Diversified	185
Event-driven	194
Long bias	931
Relative value	388
Macro	432

Source: HFRI; data as of June 2016.

Asset allocators frequently seek a more concentrated exposure to the unique alpha opportunities of hedge fund investments than that represented by an index. Therefore, forward-looking volatility assumptions need to go beyond standard index-based historical estimates that are dominated by systematic market drivers (beta), and move to a method that incorporates alpha risk as well. In developing volatility estimates, we start with the returns of the underlying managers in each hedge fund strategy index and apply various statistical techniques to capture the influence of alpha risk and correct for the risks obscured by the illiquidity of many hedge fund investments. Each of these adjustments unveils a component of risk that may have been underestimated in index construction and increases our volatility estimates to reflect a more typical hedge fund allocator's experience.

AN EXAMPLE OF THE IMPACT OF HEDGE FUND INDEX OVERDIVERSIFICATION ON VOLATILITY

We present a simple analysis to demonstrate how volatility and risk drivers can be significantly different for hedge fund allocations with 15 to 25 funds vs. those with a larger number (approaching 100 funds or more).

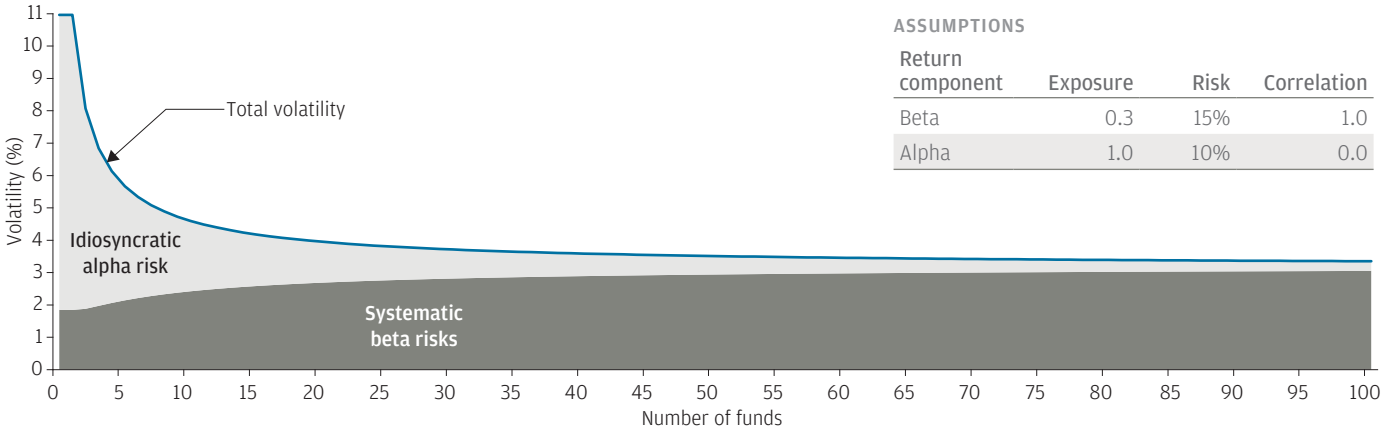
We begin with an investor who can allocate among 100 hedge funds with the following properties:

- All funds have the same low sensitivity to market moves (beta exposure = 0.3).
- Each fund has a high idiosyncratic alpha risk exposure, unique to the individual manager's strategy; alpha returns are uncorrelated with market returns and the alpha component of other managers' returns.

Incorporating these assumptions, **EXHIBIT 2** illustrates the volatility-reducing effect of diversification on an equally weighted composite of hedge funds. The combination of just a few dozen funds significantly reduces portfolio volatility but maintains a large portion of idiosyncratic risk and return drivers, whereas combining a larger number of funds (as in an index) diversifies away idiosyncratic alpha drivers.

The volatility and the composition of risk drivers for an over-diversified hedge fund index do not accurately represent that of a typical asset allocator's more concentrated portfolio.

EXHIBIT 2: PORTFOLIO TOTAL VOLATILITY* AND COMPOSITION BY NUMBER OF FUNDS



ASSUMPTIONS

Return component	Exposure	Risk	Correlation
Beta	0.3	15%	1.0
Alpha	1.0	10%	0.0

Source: J.P. Morgan Asset Management.

*See Appendix A: "Calculating return volatility for an equally weighted portfolio of funds." In this simple example, volatility statistics are not affected by the alpha and beta return assumptions, only the beta exposure and risk assumptions.

Looking deeper into the analysis, each individual hedge fund is assumed to have a volatility of about 11%, of which over 80% is driven by alpha risk. The combination of 15 to 25 funds into a more diversified hedge fund allocation is about 40% as volatile and has a roughly 40/60 split between alpha and beta risk drivers. As holdings are increased, an index-like portfolio with 100 hedge funds is even less volatile (with a volatility of roughly 3.5%) and converges toward a portfolio dominated by systematic market risk (which explains over 90% of the risk in this example). A typical asset allocator is unlikely to hold such a diversified portfolio because the resulting risk and return drivers can be accessed more easily (and cheaply) by investing in more traditional asset classes.

Our approach to estimating hedge fund volatility

To create hedge fund volatility assumptions that are more reflective of the risks inherent in a typical hedge fund allocation, we start with the full list of funds in the various HFRI strategy indices. For each hedge fund strategy type, we use a random bootstrapping[2] method to create 1,000 unique equally weighted portfolios containing three to five funds, each with at least eight years of monthly returns; we will refer to these portfolios as our "concentrated allocations." Volatility is then estimated for the portfolios, using eight to 10 years of monthly return history (driven by each fund's data availability). We analyze the distribution of volatilities for the 1,000 concentrated allocations to create our forward-looking volatility assumptions (**EXHIBIT 3**).

This method maintains a significant element of the idiosyncratic alpha risk commensurate with a multi-strategy hedge fund allocation of 15 to 25 funds across the various strategies (diversified, event-driven, long bias, relative value and macro). Comparing the volatility distribution for the 1,000 concentrated allocations with the volatility of the respective strategy index, we find that the index's value typically falls below the median, near the 75th percentile of the distribution. The large idiosyncrasies of macro hedge fund strategies result in the largest increase in volatility, with the HFRI macro index volatility falling near the 90th percentile.

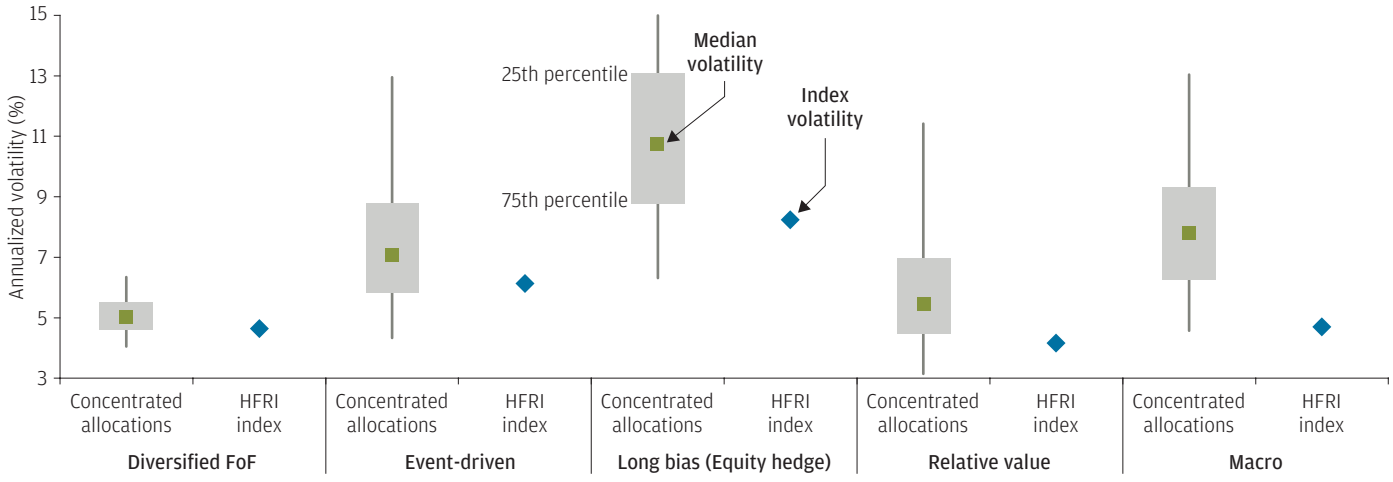
ADDRESSING THE ILLIQUIDITY BIAS

In addition to idiosyncratic alpha risks being diversified away in index construction, the true volatility of hedge fund returns can be masked by illiquidity. One of the ways hedge funds generate return premiums is through buying and holding illiquid assets.

[2] Bootstrapping is a statistical technique that randomly selects and combines subsets of data (in this case, manager return series without replacement) to reliably measure the distribution and accuracy of statistical estimates like variance. Generally, bootstrapping falls into the broader class of resampling methods that are used for trend and distribution analysis.

Hedge fund indices understate the volatility of a typical, less diversified hedge fund allocation

EXHIBIT 3: COMPARING STRATEGY VOLATILITY MEASURES: MEDIAN VOLATILITY FOR 1,000 CONCENTRATED ALLOCATIONS VS. HFRI INDEX VOLATILITY



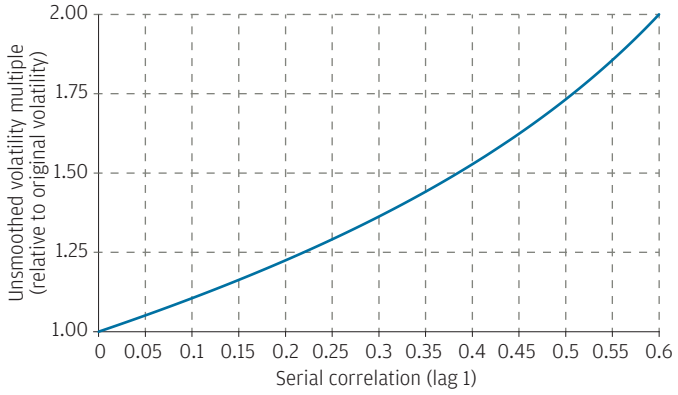
Source: J.P. Morgan Asset Management, HFRI, PerTrac; analysis as of June 2016.

Return streams for illiquid assets tend to come with "sticky" prices. Additionally, illiquid assets are often priced using various models that build on prior-period prices and/or valuation factors. These two properties can cause returns to demonstrate serial correlation (causing persistence in one period's return and the next). When returns in consecutive months are not independent but, rather, correlated, the return series is smoothed over time, which can result in an underestimation of its annual volatility.

To combat the hidden risks from illiquidity, we apply the Fisher-Geltner-Webb (1994) "unsmoothing" methodology. (See Appendix B: "Unsmoothing returns: A step by step to adjusting for serially correlated returns" for a guide to applying the method.) This statistical technique creates a new return series that removes the correlation to prior-period returns to restore independence from one month to the next. The method does not affect the average return but corrects for the influence of the correlations by producing an unsmoothed return series with higher volatility that better reflects the risk characteristics of the hedge fund assets. For example, the average hedge fund manager's returns have a serial correlation of 0.25. Applying the unsmoothing method reveals a volatility that is 1.3x the original volatility of the return series (**EXHIBIT 4**).

Hedge fund strategies exhibiting a higher degree of serial correlation require a greater upward adjustment to volatility estimates

EXHIBIT 4: INCREASE IN VOLATILITY OF UNSMOOTHED RETURNS VS. LEVEL OF SERIAL CORRELATION



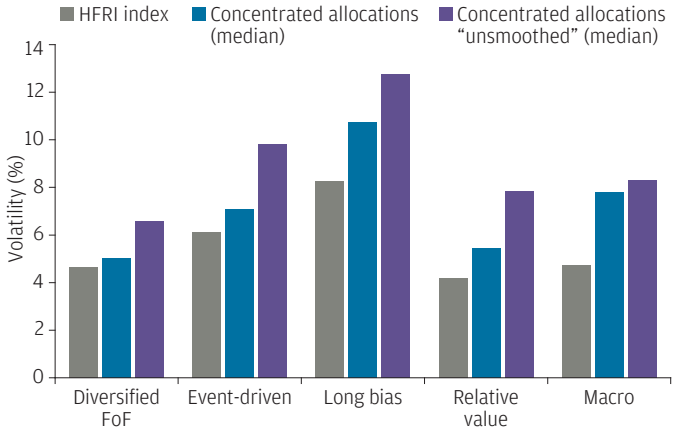
Source: J.P. Morgan Asset Management. For illustrative purposes only.

VOLATILITY DRIVERS ACROSS HEDGE FUND STRATEGIES

EXHIBIT 5 compares, among different hedge fund strategies, the potential for understating the volatility of a concentrated allocation when standard hedge fund indices are used in the estimation. The chart shows the understatement owing to (1) the overdiversification of alpha in the indices, and (2) the impact of serial correlation (due to illiquidity and pricing models) on manager returns. For each strategy, we apply the unsmoothing methodology to the individual hedge funds in our 1,000 concentrated allocations and show the median volatilities for both the original and unsmoothed returns, along with the relevant HFRI index volatility.

The impact on volatility of less diversified alpha risk and illiquidity varies across strategies

EXHIBIT 5: VOLATILITY COMPARISON ACROSS HEDGE FUND STRATEGIES



Source: HFRI, PerTrac, J.P. Morgan Asset Management; analysis as of June 2016.

The extent of the volatility increase relative to the HFRI index depends on the proportion of alpha vs. beta drivers within the strategy and the illiquidity of its investments. For instance, relative value and event-driven strategies tend to have more illiquid positions, and therefore unsmoothing results in a larger positive adjustment to volatility. On the other side of the spectrum, macro hedge funds tend to be extremely liquid and focused on uncorrelated investments. As a result, the primary driver of the upward volatility adjustment for these concentrated allocations is a greater level of alpha risk vs. the index. Long bias hedge fund volatility is almost equally affected by the addition of alpha risk and unsmoothing. Diversified funds of funds historically have had lower alpha premiums than single strategies and are mainly affected by unmasking illiquidity.

THE END RESULT: A MIX OF QUANTITATIVE AND QUALITATIVE INPUT

The distributions of the concentrated allocation volatilities, both those based on original as well as unsmoothed returns, are used as the backbone of our forward-looking Long-Term Capital Market Assumptions for hedge fund volatilities. History tends to be a decent guide for grounding volatility expectations. However, fundamental market or environmental shifts are also an important consideration for forward-looking volatility estimates. At times, therefore, qualitative adjustments are made to volatility projections. These adjustments could be influenced by: trends in hedge fund alpha production, lower for longer or rising rate environments, dispersion in traditional asset class returns, views on merger and acquisition activity or credit defaults, or a change in inflation or growth expectations—all of which have shifted relative to history.

APPENDIX A

Calculating return volatility for an equally weighted portfolio of funds

The volatility of a composite portfolio of equally weighted assets can be found using the following equation:

$$\sigma_{P,n} = \sqrt{\left(\left(\frac{n+1}{2n}\right)\beta_{MKT}^2\sigma_{MKT}^2 + \left(\frac{1}{n}\right)\sigma_\alpha^2\right)}$$

where:

$\sigma_{P,n}$ = volatility for a hedge fund portfolio of n funds

β_{MKT} = the CAPM beta exposure to the market (assumed to be the same for each fund)

σ_α = volatility of CAPM non-systematic (alpha) returns (assumed to be the same for each fund)

σ_{MKT} = volatility of the market

Source: J.P. Morgan Private Bank—CIO Quantitative Research Team.

APPENDIX B

Unsmoothing returns: A step by step to adjusting for serially correlated returns

1. Estimate the beta coefficient of a return series on a lag-one (previous month's return) through the following regression model:

$$r_t = \alpha + \beta r_{t-1},$$

where r_t represents the return at time t

2. Produce the unsmoothed return series by applying the estimated beta coefficient to the original return series with the formula:

$$r_t^{unsmoothed} = \frac{r_t - \beta r_{t-1}}{1-\beta}$$

3. Compute the standard deviation of the unsmoothed returns and annualize.

Sources

Fisher, J., D. Geltner, and B. Webb. "Value indices of commercial real estate: A comparison of index construction methods," *The Journal of Real Estate Finance and Economics* 9.2." (1994).

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